# Growth and Shocks: evidence from rural Ethiopia

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**Abstract**

Using micro-level panel data from villages in rural Ethiopia, the paper studies the determinants of consumption growth (1989-97). This is a period of economic reform, as well as a period of peace after prolonged civil war and the aftermath of the famine in the mid-1980s. A key focus is on whether shocks affect growth. Consumption grew substantially, but with diverse experiences across villages and individuals.The data suggests within-village convergence but divergence across villages. Initial levels of wealth, education and road infrastructure are sources of systematically higher growth and divergence, suggesting unequal distribution of the gains from growth during this period. Better rainfall accounts for at least a fifth of growth in this period. The impact of poor rainfall appears to persist for many years, although there is evidence that, in the end, there is a total catch-up via accelerated growth after negative shocks. Finally, there appears to be no significant, permanent growth impact from the large shocks in the 1980s, including from the famine, although there is no catching up either.

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## 1 Introduction

Since 1988, Ethiopia has gradually moved from a communist-inspired controlled economy to a more market-based economy. From 1992, these reforms became part of a structural adjustment program sponsored by the IMF and the World Bank. A key element in the reform programme was the removal of trade barriers between different regions and a general liberalisation of economic activities. Furthermore, in 1991 the government army was defeated, resulting in the end of the civil war. Finally, repeated and widespread drought episodes in the 1980s were followed by relatively better rainfall in most of the 1990s. In this paper and inspired by the standard growth literature, we use household panel data covering 1989 to 1997 and six villages across the country to study rural consumption growth in this period using a linearised empirical growth model. The data suggest convergence within communities but divergence across communities. These results hold even after controlling for idiosyncratic and common shocks: although especially better rainfall contributed to the observed growth, the observed patterns of divergence and convergence are not just a consequence of particular events. Next, these effects are unpacked, using information on locational characteristics and initial sources of capital. We also test for persistence of the effects of past shocks. We find that rainfall is an important source of 'convergence', i.e. that growth rates include some catching up from past losses, even though this recovery can take many years. We cannot find evidence of permanent growth effects from the famine in the mid-1980s, although the evidence is not conclusive on this. Finally, road infrastructure, land holdings and education are sources of divergence.

The study of growth in developing countries using micro-level household data is not common, largely because suitable panel data sets are missing to embark on such work. Deininger and Okidi [2001] and Gunning et al. [2000] look into the determinants of growth in Ugandan and Zimbabwean panel data. As part of a number of papers using data from rural China, Ravallion and Jalan [1996] use a framework inspired by both the Solow model and the endogenous growth literature to investigate sources of divergence and convergence between regions. In further work using the household level data from their panel (e.g. Jalan and Ravalllion [1997, 1998]), divergence due to spatial factors is explicitly tested for and discovered, suggesting spatial poverty traps. This paper draws inspiration from their approach by explicitly disentangling community and individual effects, even though the available data do not allow the spatial poverty trap hypothesis to be tested. However, this paper goes beyond their approach by explicitly focusing on the role of common and idiosyncratic shocks, and investigating whether there is evidence of persistence of the effects of shocks.

Virtually all households in rural Ethiopia are dependent on rainfed agriculture as the basis for their livelihoods. Drought are recurrent events, while high incidence of pests, as well as animal and human disease affect their livelihoods as well. In such risky environment, income smoothing activities may imply lower incomes, not least for those that only have low wealth holdings to serve as a buffer for income shortfalls (Morduch, [1995], Rosenzweig and Wolpin [1993]). This may be a source of divergence and differential growth across villages and individuals. Large shocks could exacerbate these effects: a drought, requiring substantial disvestment of assets to survive, or a direct loss of assets such as livestock, may require households to engage permanently in lower return activities, resulting in lower growth. However, after an initial negative growth shock, and provided there are decreasing marginal returns to each assets, it may also result in higher subsequent growth rates, for example as in a standard Solow model.

The data set used is relatively small - only 342 households with complete information for the analysis. However, the data set used has a number of advantages. To mention just a few, first, it is a panel data set, which was started in 1989 at the eve of the first wave of reforms. Data used in this period cover eight years, a sufficiently long time frame to start developing a more comprehensive picture of the growth experience in the 1990s. Furthermore, the data is large and comprehensive, including on events, shocks and experiences over the survey period as well as based on longer-term recall - including information on experiences during the (by far largest recent) famine in the mid-1980s.

The sample is not a random sample of rural communities in Ethiopia, but they were initially selected since they had suffered from the drought in the mid-1980s, which had developed into a large scale famine due to the civil war and other political factors. During the 1990s, growth rates in GDP picked up considerably, with GDP per capita growing by about 14 percent between 1990 and 1997 (the study period). While economic reform is likely to have been a necessary condition for this growth experience, it begs the question whether these growth rates should not be largely viewed as recoveries from earlier shocks. Indeed, it took until about 1996 for GDP per capita to surpass levels reached in the early 1980s, before the war, famine and repressive politics plunged Ethiopia into the crisis of the late 1980s. Furthermore, growth rates fluctuated considerably as well in the 1990s. In the survey villages, the issue of recovery and weather induced growth may even be more important. Consumption growth was well beyond national levels in the 1990s, implying impressive poverty reductions (Dercon [2002]). However, since the villages were chosen because the famine had strong effects, the question of recovery and differential effects across households and villages in this recovery becomes crucial.

The contribution of economic policies, not least from regional trade liberalisation, will have to be seen in this light as well. The impact of trade liberalisation on economic growth and convergence is not self-evident, neither theoretically nor empirically (Ben-David [1993], Deardoff [2001]). The trade regime in the 1980s can be understood as a system of regional export and import tarriffs and licenses, at least for agricultural commodities. Its abolition in 1990 effectively created free trade in most food products, which are likely to have resulted in gains from trade. Evidence on the study communities suggest that this indeed took place (Dercon [2002]). The distribution of these gains is however less clear a priori, as are their growth effects. Some tentative evidence on this can be presented here.

In the next section, I present our theoretical and empirical framework. It is based on the standard 'informal' empirical growth model, drawing inspiration from both Mankiw et al. [1992] and endogenous growth theory, e.g. Romer [1986]. A number of testable hypotheses are derived. In section 3, the context and data are presented. In section 4, the econometric specifications are discussed and the estimates are presented. Section 5 concludes.

## 2 Theoretical and empirical framework

The framework used is a standard empirical growth model, allowing for transitional dynamics, inspired by Mankiw et al. [1992]. In this model, growth rates will be negatively related to initial levels of income, as well as related to a number of variables determining initial efficiency and the steady state, including investment rates in human and physical capital. In the context of panel data on per worker incomes of $N$ households $i$ $(i = 1, ...N)$ across periods $t$, $y_{it}$, this empirical model can be written as (see e.g. Islam [1995]):

$$\ln y_{it} - \ln y_{it-1} = \alpha_t + \beta \ln y_{it-1} + \delta Z_{it} + u_{it} \qquad (1)$$

in which $Z_{it}$ are time-varying and fixed characteristics of the household, for example determining savings rates or investment in human capital, while $\alpha_t$ is a common source of growth across households, and $u_{it}$ is a transitory error term with mean zero. There are numerous reasons why one should be careful in applying this framework to any context, given the theoretical and empirical assumptions implied by this model (for example, see the reviews by Temple [1999] or Durlauf and Quah [1998]). Still, one could use this framework as a starting point for the evaluation of conditional convergence using household data: a negative estimate for $\beta$ would suggest convergence, allowing for underlying differences in the steady state. A relevant question in this respect is at which level this convergence is occurring: within or between villages. Equation (1) can be rewritten as:

$$\ln y_{it} - \ln y_{it-1} = \alpha_t + \beta(\ln y_{it-1} - \ln \overline{y}_{it-1}) + \beta_1 \ln \overline{y}_{it-1} + \delta Z_{it} + u_{it} \qquad (2)$$

in which $\overline{y}_{it-1}$ is the average per worker income in a community. A rejection of the null hypothesis of $\beta_1 = \beta$ would suggest that convergence within and across villages is occurring at different speeds. Of course, the growth theoretical literature is far richer than implied in this discussion. In different endogenous growth models, convergence may not exist. For example, models such as Romer [1986] imply that overall, inputs exhibit increasing returns to scale, so that capital levels (and by implication, output levels) may be positively related to growth levels. Ravallion and Jalan [1996] exploit this in the context of a convergence test, by distinguishing regional versus household initial levels of capital. A positive estimate for $\beta_1$, for example, would suggest divergence related to external effects from community wealth levels. Unpacking these effects further into the role of initial conditions in terms of different capital goods allows a more careful discussion of the role of different types of initial conditions in this respect. For example, let us define $k$ as physical capital per worker and $h$ as human capital per worker and let us write the relationship as in (2), but now in terms of capital goods as[1]:

$$\ln y_{it} - \ln y_{it-1} = \alpha_t + \gamma(\ln k_{it-1} - \ln \overline{k}_{it-1}) + \gamma_1 \ln \overline{k}_{it-1} + \eta(\ln h_{it-1} - \ln \overline{h}_{it-1}) + \eta_1 \ln \overline{h}_{it-1} + \delta Z_{it} + u_{it} \quad (3)$$

Although in the Solow model growth rates will be decreasing in the level of a each production factor, the specification in (3) allows growth rates to be increasing functions of the endowment of some factors and decreasing of some other factors, as in some endogenous growth models. Shocks have no explicit role to play in this formulation, even though it is generally acknowledged that shocks, e.g. due to climate, could be an appropriate justification to introduce a stationary error term. One way of interpreting this effect is that initial efficiency (the technological coefficient in the underlying production function) may be influenced by period-specific conditions (Temple [1999]). An important shortcoming of such approach is that it is assumed that there is no persistence in the impact of shocks. An alternative route would be to introduce information about shocks directly in (1) to (3). To do so, and again referring back to the Cobb-Douglas technology assumptions as in the Solow model, let us assume that there is multiplicative risk, affecting the technological coefficient. Let us call the value of this source of risk at t $S_{it}$, which could be thought of as rainfall or a measure of health status in this particular period. This risk could be idiosyncratic or common. It is then possible to introduce risk into equations (1) to (3), both as controls for shocks in growth rates, as well as to investigate whether there is any tendency of convergence or divergence in relation to shocks. No further distributional assumptions about these shocks need to be imposed. For example, (3) with explicit allowance for shocks could be written as[2]:

$$\ln y_{it} - \ln y_{it-1} = \alpha + \gamma(\ln k_{it-1} - \ln \overline{k}_{it-1}) + \gamma_1 \ln \overline{k}_{it-1} + \eta(\ln h_{it-1} - \ln \overline{h}_{it-1}) + \eta_1 \ln \overline{h}_{it-1} + \theta(\ln S_{it} - \ln S_{it-1}) + \lambda \ln S_{it-1} + u_{it} \quad (4)$$

Equation (4).controls for shocks in assessing the role of different factors in determining growth. A positive impact from positive shocks (changes in the log of $S$) would be expected. However, it also allows us to assess whether, after the realisation of a poor value of $S$, growth rates increase to allow levels of income to catch up to earlier levels - negative $\lambda$, or convergence, or whether this shock results in a persistent loss (no convergence or zero $\lambda$), or even a permanent loss (positive $\lambda$), implying divergence in the aftermath of shocks.

[1] Given Cobb-Douglas production technology defined over capital, labour and human capital, and constant returns to scale, as in the original Solow model, then (3) follows directly, from (2), and $\gamma$ and $\eta$ can be derived from the parameters of the production function and $\beta$.

[2] In this formulation it is assumed that all cross-sectional variation in growth rates is captured by initial capital and by shocks, with no further individual heterogeneity. In principle, this may not be correct but with only a limited number of survey rounds, further testing for this effect is not possible in this paper.

## 3 Context and data

Around 1990, Ethiopia has started to make a transition away from a totally controlled economy. Before 1990, the restrictions on and taxation of the rural economy were substantial. Farmers in the main cereal growing areas had to supply a predetermined quota to the government (via a parastatal) at a fixed low price. The rest could be sold to traders. Trade across districts and regions was nevertheless restricted by taxation: when crossing predetermined borders, traders had to sell part of their stock to the government parastatal, again at below market prices, implying a high sales tax. Taxation and levies on rural households (such as infamous war levies and famine levies) were substantial as well. Factor and other markets were restricted as well. Land was (and is) state-owned, and after the first (large scale) land reform in 1976, land continued to be redistributed in these villages. Rural wage and other factor markets were also repressed, while private trade and initiative were all but encouraged.

Despite a strong discouragement of private sector initiative and widespread nationalisations, war with Somalia and a famine in the mid-1980s, the macro-economy retained a semblance of stability for a long time. Only after the fall of the Berlin wall were pressures increasing, for example through growing over-valuation of the birr exchange rate. Reforms started in 1990, with substantive liberalisation of food markets. In 1991, the government army was defeated. The takeover resulted not just in a collapse of government revenue collection but also of government spending, despite a few months period of threatening hyperinflation.

Reforms continued with a devaluation of 142 percent in 1992 - which was successfully transformed in a real exchange rate depreciation. A few good harvests appear to have helped the recovery. Since 1994, adjustment efforts have been sponsored by IMF and World Bank, and further liberalisation has taken place, including related to exchange rate determination, investment and trade liberalisation. Fertiliser markets have also been tentatively liberalised and subsidies were removed. Donor efforts have also contributed to a substantial rise in public investment including long overdue improvements in road infrastructure and rural public services. Finally, a large agricultural production promotion programme was started, focusing on input packages (seeds and fertiliser), increased agricultural credit and extension efforts.

The rural economy was strongly affected by the economic reform programme. First, the internal market liberalisation resulted in price-equalising forces between regions. Staple food prices in Addis Ababa and in deficit areas remained more or less stable, but price margins declined. Producers in surplus areas gained in real terms. In Dercon [1995] this has been studied further and it was found that the main changes can be dated as having occurred during the early liberalisation, even before the end of the war. This movement in prices can therefore be directly linked to the reforms. From the mid-1990s, with a series of good harvests and possibly yield increases linked to the increased input and extension efforts, grain prices appear to have experienced downward pressure across the country. Tradeable non-food crop production, such as coffee and chat (or q'at, a mild stimulant, popular in the Eastern part of Ethiopia and surrounding countries) also seems to have expanded in this period, although the effects are complicated due to world coffee price fluctuations and the gradual disappearance of smuggling routes with high returns to farmers. Fewer restrictions on the movement of goods and people, and on private sector activities in urban areas appear to have resulted in expanding trade and small-scale non-agricultural activities. The return to peace in 1991 will have contributed to this as well.

The data used in this paper is from six communities in rural Ethiopia. In each village, a random sample was selected, yielding information on about 350 households (the attrition rate between 1989 and 1994 was about 3 percent, between 1994 and 1997 only about 2 percent)[3]. The villages are located in the central and southern part of the country. In 1989, the war made it impossible to survey any northern villages. Nevertheless, the villages combine a variety of characteristics, common to rural Ethiopia. Four of the villages are cereal growing villages, one is in a coffee/enset area and one grows mainly sorghum but has been experiencing rapid expansion of chat. All but one are not too far from towns, but only half have an all-weather road. The villages were initially selected to study the crisis and recovery from drought and famine in the mid-1980s (Webb et al. [1992]). Details on the survey are in Dercon and Krishnan [1998] and in Dercon [2002].

The households in the survey are virtually all involved in agriculture. Almost all have access to land, although with important differences in quality and across villages. On average, about half their income is derived from crops, the rest from livestock and off-farm activities. Most of the off-farm activities (such as selling home-made drinks or dungcakes) are closely linked to the agricultural activities. Alternatives are collecting firewood, making charcoal and weaving.

In this paper, I use data from 1989 and from the revisits during four rounds in 1994-97. The data from 1989 reflect conditions on the eve of the reforms, while the later data are from well into the post-reform period. During this period, the civil war affected the communities relatively little, at least in terms of direct effects. With most fighting in the north of the country, in none of the villages was any fighting or other direct effects from the war reported. Consequently, the direct effects of increased security, such as more opportunities for mobility towards local markets and lower price margins, are unlikely to have been very important, although care will have to be taken in interpreting any of our results in this light.

Growth is measured using the growth rates in food consumption. Non-food consumption data were not collected in 1989, so the analysis had to limit itself to food consumption. Data are reported in per adult equivalent and in real terms, in prices of 1994. The food price deflator and any other price data used in this

[3] It is worthwhile to comment on the definition of the household used in these 8 years. The household was considered the same if the head of the household was unchanged, while if the head had died or left the household, the household was considered the same if the current household head acknowledged that the household (in the local meaning of the term) is the same as in the previous round.

study are based on separate price surveys conducted by the survey team and by the Central Statistical Authority. Nutritional equivalence scales specific for East-Africa were used to control for household size and composition. Since food consumption is unlikely to be characterised by economies of scale, no further scaling is used (Deaton [1997]).

The underlying questionnaire was based on a one-week recall of food consumption, from own sources, purchased or from gifts. Seasonal analysis using the panel revealed rather large seasonal fluctuations in consumption, seemingly linked to price and labour demand fluctuations (Dercon and Krishnan [2000a]). Therefore, the data used for the analysis in this paper are for food consumption levels in the same season as when the data had been collected in 1989, as the measure for food consumption in 1994/95. Consequently, only one observation of the three possible data points collected during the 1994/95 rounds is used. The data for 1997 are matched to those of 1994/95 in a similar way. The result was three observations on food consumption (1989, 1994/5 and 1997) for each household. Table 1 reports average real consumption per adult for each village. The table suggests substantial growth in mean per adult food consumption in this period: equivalent to more than 9 percent per year. There are nevertheless substantial differences between villages. In all but one, growth was above national growth rates. Elsewhere, the poverty evolution was studied, and the data revealed substantial poverty declines as well, but again with substantial differences between villages (Dercon and Krishnan [1998]).

These declines are somewhat surprisingly high and they definitely do not square with the overall impressions of rural Ethiopia in this period. In general, an improvement in living standards could be expected but not at this scale. Nationally representative data for rural Ethiopia are only available for 1995 and 2000; provisional estimates suggest some declines in rural Ethiopia but not at this scale. However, the findings on other welfare indicators in the national Welfare Monitoring Survey would not necessarily contradict some substantial improvement. Primary school enrolment, for example, doubled in both gross and net terms between 1994 and 1998. But this only brought net primary enrolment to about 19 percent. For these and other enrolment measures, only by 1997 were the levels from before the 1985 famine reached again. In short, the increases in consumption in the sample may be an overestimate, but other indicators suggest substantial upward movement in rural areas. But much of this movement may well be recovery from the lower levels in the late 1980s.

A look at the evolution of livestock confirms large positive improvements in this period (table 2). As in many of the poorest countries in the world, livestock is by far the most important marketable asset and typically is accounting for more than 90 percent of the value of assets. In all but one village, livestock values increased considerably during the survey period - and in terms of standardised units, the improvement is general, since prices for livestock in fact had declined relative to rural consumer prices. In some areas, the increase is substantial; overall the increase is 50 percent in value terms, while in terms of units, a 100 percent increase can be noted. Only in Debre Berhan, where levels were consistently highest, did values not quite increase. The patterns across villages are consistent with the evolution in mean consumption.

Both the high consumption and livestock levels may well have been helped by the overall rainfall pattern in this period. Table 3 gives details of the recent rainfall experience in these villages. Rainfall was on average better in more recent rounds, so it could plausibly account for some of the large increases. This will be addressed in the econometric analysis. Note also the large fluctuations in rainfall in some of the villages in this period, and that mean levels in the 1990s have been above 'long-term' levels - which are strongly influenced by the disastrous levels in the early 1980s in these communities. In the next section, the role played by rainfall and other shocks relative to other factors in the recent growth experience is explored.

# 4 Data analysis and results

In this section, the framework and equations developed in section 2 will be tested to explore the determinants of consumption growth in the 1990s in rural Ethiopia, with an emphasis on the role played by shocks relative to other factors. The left hand side variable used is the annualised growth rate in real consumption per adult between 1989 and 1994, and between 1994 and 1997. A number of different specifications will be explored, closely related to equations (1) to (4). All reported standard errors are robust estimators, controlling for community cluster effects. All growth regressions tested allow for shock variables. Rainfall shocks are defined as the change in the logarithm of rainfall at $t$ relative to $t-1$. The data set also includes information on idiosyncratic shocks: an index of reported crop damage due to a number of reasons, including frost, animal trampling, weed and plant disease. 'No problems' is equal to the value one, while problems reduce the index. An index of the extent to which livestock suffered due to lack of water or fodder is also included (the value one is best). Whether adults suffered serious illness, affecting the ability to work in between rounds, is included as well (zero is no illness). More details on these measures can be found in Dercon and Krishnan [2000b].

The first set of regressions include lagged consumption as a regressor. This may present econometric problems related to the endogeneity of lagged consumption in a consumption growth regression. All equations involved were also estimated using instrumental variables, including household and locational characteristics related to land, labour, human capital and infrastructure at $t-1$ as instruments. A Hausman test for endogeneity could *never* reject the assumption of exogeneity. Similarly, using lagged characteristics $(t-2)$ and using twice lagged consumption as instruments similarly showed that exogeneity of lagged consumption could not be rejected[4]. As a consequence, I only report the uninstrumented regressions - in any case, the estimated coefficients were qualitatively very similar (which is of course what the Hausman test systematically

[4] Note that when using two lags, the regressions were reduced to a cross-section estimate of growth rates between 1994 and 1997, using values in 1989 as instruments.

investigated, by comparing the actual estimated coefficients using 2SLS versus OLS).

The data showed signs of overall convergence - an OLS regression as in (1), controlling for the different shocks defined above found a negative coefficient on lagged consumption of -0.11, which would in fact mean relatively high convergence. IV-estimates suggested a coefficient closer to zero (and insignificant) but the Hausman test cannot reject the null hypothesis of consistency of the OLS estimates ($\chi^2(5)$=1.06, p-value=0.96). Column 1 in table 4 gives the results for a specification, equivalent to equation (2), with lagged household consumption, lagged village consumption and the idiosyncratic shock variables as defined before. Long term rainfall in this regression is defined as the change in the logarithm of average rainfall in the period (t, t-1) compared to (t-1, t-2).[5]. The regression suggests convergence within villages but significant divergence across villages. The Hausman test suggests that endogeneity is not driving these results[6]. Furthermore, common rainfall shocks are significant: a one percent growth in average rainfall in this period resulted in 0.82 percent higher annual consumption growth. The idiosyncratic shocks all have the expected signs, even though only livestock shocks are significant at 5 percent. Since average rainfall grew by about 6 percent between 1994 and 1997, rainfall can account for at least a fifth of the consumption growth in these villages in this period. Since I use consumption growth (and not income growth) as the left hand side variable, it also suggests that consumption smoothing around a long term growth path of consumption is not occurring, i.e. that there are imperfections in credit and insurance markets. Column 2 gives a further exploration of this rainfall effect, by distinguishing differences in rainfall in the year just before each survey round, and differences in average rainfall in the preceding years. For example, it could be that only the most recent rainfall failures affect consumption, but recovery is swift. The results show that more recent shocks appear to have an impact, but that differences in consumption over longer periods are also influenced by rainfall in all the preceding years. In other words, this suggests some persistence over many years of rainfall shocks, i.e. growth does not pick up immediately to undo the losses in a particular year.

Next, in column 3, lagged consumption is replaced by initial levels of different sources of capital, to explore the determinants of growth. In particular, I include initial levels of land per adult (in ha), educational levels (years of education per adult) and whether the village is connected by an all weather road (a dummy variable - only half the villages have such a road). Similar to equation (3), I include village level averages for land and educational levels. The results show

[5] For the period before 1989, the period for calculating the average rainfall in this period is five years (i.e. just as between 1989 and 1994).

[6] To provide a better estimate of the coefficient related to within-village intial consumption, the same specification was run again, but now replacing common shocks and village consumption by time-varying fixed effects. The coefficient on lagged consumption was virtually identical, confirming within-village convergence. A specification with community fixed effects but including rainfall also gave very similar coefficients as before on rainfall, lagged consumption and all other variables. This suggests that rainfall and initial consumption capture well cross-sectional growth rate difference between villages.

similar effects for the shock variables as before. Land holdings are a significant source of divergence between communities, even though within communities it may be a source of convergence (p=0.142)[7]. Education level at the household and community level have positive but not significant coefficients. However, testing whether they should be jointly dropped from the regression strongly rejected the null hypothesis that their coefficients were jointly zero (F(2,8)=7.69, p=0.01. Restricting the regression to only the household level variable suggested strongly significant divergence effects. One must be careful in interpreting these results: in the sample, adult educational levels are still very low, on average less than one year of school per adult. A strong and significant growth effect appears to stem from infrastructure: having a road adds 25 percent growth in this period.

Taken together, these results suggests that between villages, those with on average more land (wealth) and better infrastructure benefited most from growth in this period. This would be consistent with these households benefiting from more opportunities to trade and from better incentives for crop production, following the reform programme and the end of the war. Land holdings differentiation within villages may have contributed to some convergence, as if those with relatively less land could have had higher marginal returns to land in this period of generally improved incentives. Finally, idiosyncratic and common shocks mattered for growth in this period as well.

The regression also includes a measure of average rainfall in the period preceding t-1. The negative and significant coefficient signifies that there is 'catching up' in terms of growth: the loss from lower rainfall is recovered in the next period. In fact, the coefficient is insignificantly different from the coefficient on rainfall changes in absolute terms (at 10 percent or less), suggesting total catch-up in the subsequent period. Note that this does not exclude some persistent effects (as in column 2) - they persist if the average rainfall shocks are separated into short and long term shocks. But it means that these effects do not persist indefinitely - growth accelerates to allow a recovery, to catch up on earlier losses in consumption levels in due course.

A final test for persistent growth effects from shocks uses recall information on the household's experience during the land reform in the late 1970s and on losses in livestock during the famine of the mid-1980s. In particular, a dummy was introduced on whether the household lost land during the last reform (more than 25 percent of the sample lost land), and an estimate (based on recall data) of the value of the livestock herd sold or lost during the famine as a percentage of the total herd value at the time (on average about 30 percent). Negative coefficients on either variable would suggest persistent growth effects. Column

[7] Note that land sales are illegal in Ethiopia, so that growth is not driven by accumulating this source of wealth. Nevertheless, it suggest that wealth differences are one factor explaining between village divergence in the data. I experimented with a few alternative specifications, including one in which initial livestock holdings at t-1 were entered as well. The result was that land was not significant, but village level livestock holdings showed divergent growth between communities. This supports the interpretation that wealth, however measured, is a relevant source of divergence.

4 shows this specification. It can be seen that the coefficient are negative but not significant. For example the percentage of the herd lost is only significant at 20 percent. In any case, no growth accelerating 'catching up' can be detected (via a significant growth accelerating effect after past hardshiop), although given the length of time past, this recovered may have been completed earlier.

# 5 Conclusions

In this paper, I analysed the growth experience in a number of villages in rural Ethiopia using a household panel data set covering 1989 to 1997. The results suggest some convergence within communities, but divergence across communities. Unpacking these effects, we find evidence that community level differences in land and infrastructure can account for this divergence. Within villages, land holding differences may assist convergence. Common and idiosyncratic shocks have substantial growth effects, possibly persisting over several years, but full catching up occurs in the form of accelerating growth in the period after a negative event The impact of large shocks, such as asset losses during the famine or the impact of the land reform, both affecting a large number of households, is less clear. There is no evidence of persistent growth effects, but also not of catching up for these shocks. To investigate this more fully, better data will need to be available.

This growth episode occurred in a period of trade and other reform within Ethiopia. The nature of the effects is suggestive of the impact of this reform programme. In general, it does not appear that all households benefited in the same way. The fact that shocks do not account for all growth seems consistent with better incentives and possibilities to trade and produce after the liberalisation and peace. But the fact that this coincides with divergence linked to road infrastructure and wealth (in the form of land or livestock) suggests that not everybody has gained to a similar extent. This may imply that some areas may permanently stay behind with low growth, unless their ability to participate in the growth can be strengthened.

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**Table 1 Changes in food consumption per adult equivalent (between 1989 and 1997) (in birr, 1994 prices) (n=344) (6 birr » 1 US $ in 1994)**

| | DINKI | DEBRE BERHAN | ADELE KEKE | KORO DEGAGA | GARA GODO | DOMAA | ALL |
|---|---|---|---|---|---|---|---|
| mean food cons 1989 | 50 | 53 | 64 | 37 | 27 | 25 | 42 |
| mean food cons 1994 | 62 | 96 | 108 | 40 | 20 | 80 | 64 |
| mean food cons 1997 | 62 | 162 | 123 | 65 | 73 | 49 | 88 |
| yearly growth mean (%) | 3.0 | 14.9 | 8.5 | 7.1 | 13.3 | 8.8 | 9.7 |

Source: own calculations from Ethiopian Rural Household Survey.

**Table 2 Livestock Holdings per adult equivalent**
**(in livestock units and in values, deflated by consumer prices of 1994)**

| | DINKI | DEBRE BERHAN | ADELE KEKE | KORO DEGAGA | GARA GODO | DOMAA | AVERAGE |
|---|---|---|---|---|---|---|---|
| **Livestock values** | | | | | | | |
| 1989 | 461 | 1598 | 138 | 178 | 98 | 4 | 427 |
| 1994 | 272 | 1402 | 200 | 438 | 64 | 158 | 454 |
| 1997 | 592 | 1381 | 314 | 820 | 126 | 248 | 634 |
| **Livestock units** | | | | | | | |
| 1989 | 0.43 | 1.53 | 0.14 | 0.18 | 0.11 | 0.01 | 0.41 |
| 1994 | 0.38 | 1.55 | 0.27 | 0.65 | 0.14 | 0.32 | 0.60 |
| 1997 | 0.62 | 1.81 | 0.40 | 1.01 | 0.29 | 0.43 | 0.82 |

Livestock units are standard tropical units of different types of livestock, calculated on the basis of oxen=1, cows=0.70, bulls=0.75, horse=0.5, goat=0.1, sheep=0.1 and other similar values.

**Table 3 Rainfall 1989 and 1997**

| rainfall in particular period as a percentage deviation from the mean | DINKI | DEBRE BERHAN | ADELE KEKE | KORO DEGAGA | GARA GODO | DOMAA | ALL (weighted) |
|---|---|---|---|---|---|---|---|
| 1988-89[a] | -13 | +6 | -7 | +22 | +5 | -13 | +2 |
| 1993-94 | +16 | +7 | +13 | -19 | -8 | +16 | +4 |
| 1996-97 | -23 | +4 | +52 | +32 | +7 | -23 | +10 |
| 1985-89[b] | +5 | -1 | +5 | +16 | +7 | -6 | +4 |
| 1990-94 | -6 | -2 | +17 | +21 | -7 | +6 | +4 |
| 1994-97 | +6 | -15 | +18 | +48 | +9 | -2 | +8 |
| Average level (mm)[c] | 1664 | 919 | 632 | 672 | 941 | 1117 | 1009 |

Rainfall in nearest rainfall station, based on data from the National Meteorological Office, Addis Ababa. Data are percentages of the mean rainfall.

[a] Rainfall in the 12 months preceding the survey. Expressed as a percentage deviation from the mean

[b] Average yearly rainfall covering the years before the interview.

[c] Relative to the mean (based on available observations, typically the last 15-20 years).

Figure 1:

**Table 4**

**Econometric model real consumption growth between t-1 and t. Dependent variable: change in log consumption per adult, pooled 1989-1997. Robust standard errors corrected for village cluster effects.**

| | **Model 1** | | **Model 2** | | **Model 3** | | **Model 4** | |
|---|---|---|---|---|---|---|---|---|
| | **Coeff** | **p-value** | **coeff** | **p-value** | **coeff** | **p-value** | **coeff** | **p-value** |
| Constant | -0.026 | 0.926 | 0.181 | 0.377 | 0.048 | 0.451 | 0.066 | 0.252 |
| ln cons $_{t-1}$ | -0.171 | 0.001 | -0.178 | 0.001 | | | | |
| ln village cons$_{t-1}$ | 0.233 | 0.052 | 0.178 | 0.046 | | | | |
| $\Delta$ ln (rain since last wave) | 0.818 | 0.049 | | | 0.666 | 0.081 | 0.683 | 0.073 |
| $\Delta$ ln (rain last year) | | | 0.425 | 0.008 | | | | |
| $\Delta$ ln (rain since last wave, not last year) | | | 0.311 | 0.099 | | | | |
| Non-rain shocks (1 is best) | 0.096 | 0.298 | 0.099 | 0.190 | 0.127 | 0.080 | 0.121 | 0.088 |
| Livest. shock index (1 is best) | 0.151 | 0.046 | 0.137 | 0.132 | 0.097 | 0.140 | 0.093 | 0.169 |
| adults serious illness | -0.058 | 0.284 | -0.049 | 0.187 | -0.055 | 0.228 | -0.055 | 0.227 |
| ln (land in ha + 0.1)$_{t-1}$ | | | | | -0.027 | 0.142 | -0.027 | 0.140 |
| village ln(land in ha +0.1)$_{t-1}$ | | | | | 0.076 | 0.025 | 0.077 | 0.017 |
| ln(yrs adult educ+1)$_{t-1}$ | | | | | 0.021 | 0.246 | 0.019 | 0.381 |
| village ln(yrs adult educ+1)$_{t-1}$ | | | | | 0.098 | 0.320 | 0.112 | 0.300 |
| any road infrastructure? | | | | | 0.255 | 0.003 | 0.253 | 0.003 |
| rain since last year$_{t-1}$ | | | | | -0.901 | 0.036 | -0.885 | 0.046 |
| % of herd lost in famine | | | | | | | -0.037 | 0.203 |
| lost land in land reform | | | | | | | -0.027 | 0.385 |
| | n=651 | | n=651 | | n=651 | | n=646 | |
| | *Hausman* $c^2(6)=0.40$ | | | | | | | |
| R squared | 0.160 | | 0.178 | | 0.182 | | 0.186 | |

Figure 2: